

REMARKS

Favorable reconsideration of this application is respectfully requested.

The specification is amended by the present response to correct minor informalities.

Replacement Figures 2B, 3, 4B, 4C, 13, and 16C are submitted herein to address the drawing objections noted in the Office Action.

Replacement Figures 2 and 13 correct a misspelling to now recite the word --Transmission--. Replacement Figure 16C corrects a misspelling to now recite the word --Measured--.

Replacement Figure 3 now properly includes the identifier --f2--. Replacement Figure 4B now properly includes the term --f2-f--. Replacement Figure 4C now properly shows the dotted line and includes the proper term --f2-f--.

The replacement figures are believed to address the outstanding objections to the drawings.

Claims 1-20 are pending in this application. Claims 9-17, 19, and 20 stand withdrawn from consideration. Claims 1-8 and 18 were rejected under 35 U.S.C. §102(b) as anticipated by U.S. patent 6,117,082 to Bradley et al. (herein "Bradley"). Claims 1-8 and 18 were rejected under 35 U.S.C. §102(e) as anticipated by U.S. patent 6,440,075 to Averkiou. Those rejections are traversed by the present response as discussed next.

The claims are amended by the present amendment to clarify features recited therein. The claims now more properly recite the term "frequency component" rather than "fundamental wave". Independent claims 1 and 18 now also clarify control of "a phase difference between the first frequency component and the second frequency component to control the interaction" between the second frequency component included in a reflected wave with the second harmonic wave of the first frequency component. Thereby, as now recited in independent claim 1, an ultrasonic diagnostic equipment includes:

a transmission ultrasonic wave generation unit which generates a transmission ultrasonic wave that has, at least, a first frequency component, and a second frequency component at a frequency higher than that of the first frequency component, and which generates the transmission ultrasonic wave by controlling the frequency of at least one of the first and second frequency components so that, in a case of transmitting the transmission ultrasonic wave to a patient and receiving a reflected wave therefrom, a difference frequency component between the first frequency component and the second frequency component as is included in the reflected wave may interact with a second harmonic wave of the first frequency component, and also by controlling a phase difference between the first frequency component and the second frequency component to control the interaction;

a transmission unit which transmits the transmission ultrasonic wave including the first frequency component and the second frequency component to the patient;

Independent claim 18 recites similar features.

With such claimed features, a transmission ultrasonic wave including a first frequency component and a second frequency component can be transmitted, for example, at a time to control the interaction between a difference frequency component and the second harmonic wave of the first frequency component. Thereby, a visualization using an echo signal obtained by the transmission can be realized.

Addressing first Bradley, Bradley discloses for example at column 4, lines 33-60 that an ultrasonic wave including seed components with 180° apart phases is transmitted, and one of the echo signals obtained by the application of the transmission, which contains a higher-level bubble destructing signal, is used for visualization. That disclosure in Bradley indicates it is sufficient if an ultrasonic wave containing two seed components with 180° apart phases is transmitted, and seeds serving as the cores of signals for visualization are selected in accordance with the results of the transmission. In Bradley the combination of a seed component having a phase of 0° and a seed component having a phase of 180° , or that of a

seed component having a phase of 90° and a seed component having a phase of -90° , is regarded as a combination example of two seed components with 180° apart phases.

Thereby, Bradley merely discloses examples in which phase differences between two seed components is fixed to 180° . Bradley is not directed to the claimed features of controlling a phase difference between a first frequency component and a second frequency component to control the interaction between a difference frequency component and the second harmonic wave of the first frequency component.

Moreover, applicants submit that if Bradley was applied to the claims, the fundamental frequency f_0 in Bradley would correspond to the claimed "second frequency component", and the fundamental frequency f_0/n (or fractional seed harmonic) in Bradley would correspond to the claimed "first frequency component". That would have to be the only possible interpretation applying Bradley to the claims because in the claims the second frequency component has a higher frequency than the first frequency component. However, the Office Action improperly takes an opposite interpretation in Bradley.

In that respect applicants also draw attention to Bradley at column 4, line 61 to column 5, line 17 that describes that a spectral level obtained when the fundamental frequency $f_0=4\text{MHz}$ and the fundamental frequency $f_0/n=2\text{MHz}$ (i.e., $n=2$). In that case, the difference frequency component between the fundamental frequency f_0 and the fundamental frequency f_0/n is 2MHz , and the second harmonic component of the fundamental f_0/n is 4MHz , which indicates that the difference frequency component and the second harmonic component do not interact with each other. This is also evident from Figures 2a and 2a of Bradley, which show a case in which the difference frequency component and the second harmonic component do not interact with each other.

From such a disclosure, it clear that Bradley does not disclose or suggest the claimed features of controlling the phase difference frequency component between the first frequency

component and the second frequency component to control the interaction between the different frequency component and the second harmonic wave of the first frequency component.

In such ways, the claims as written are believed to clearly distinguish over Bradley.

With respect to Averkiou, Averkiou merely describes a phase inversion in pulse inversion. Pulse inversion in Averkiou indicates a technique of adding echo signals obtained by individually transmitting ultrasonic signals of opposite phases.

The claims are not directed to a system such as in Averkiou. More specifically, in contrast to Averkiou, in the claimed ultrasonic transmission/reception equipment and method, the interaction between the difference frequency component and the second harmonic of the first frequency component can be caused by simply transmitting an ultrasonic wave including the first and second components at a time (although the signal may be transmitted a plurality of times). The concept of controlling such an interaction is completely irrelevant to a pulse inversion such as in Averkiou.

Thereby, Averkiou is also believed to not at all correspond to the features now clarified in the claims.

Moreover, applicants submit the above-discussed “phase difference between the first frequency component and the second frequency component” provides an unexpected result in the claimed invention that the transmission ultrasonic wave including the first frequency component and the second frequency component can be transmitted, for example, at a time to control the interaction between the difference frequency component and the second harmonic wave of the first frequency component. Thereby, visualization using an echo signal obtained by the transmission can be realized. Neither of the applied art to Bradley nor Averkiou even address such features and do not recognize being able to obtain such an unexpected result as in the claimed invention.

In view of the foregoing comments applicants respectfully submit the claims as written clearly distinguish over both Bradley and Averkiou.

As no other issues are pending in this application, it is respectfully submitted that the present application is now in condition for allowance, and it is hereby respectfully requested that this case be passed to issue.

Respectfully submitted,

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